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(54) Control assembly for four-line kites

(57) A control assembly (50) for a four-line power kite, comprising: a tether (52) for tethering an individual to a pair of front lines (20C,D) of the power kite; an elongate member (54) having a pair of opposed ends (56A, B), each for attachment to one of a pair of rear lines (20A,B) of the power kite; and a guide member (58) mounted on or in the elongate member between the opposed ends and defining an aperture (60) for slidably receiving the tether when varying position of the elongate member along the tether. The tether (52) has a profile which provides a plurality of discrete positions for interengagement with a corresponding profile of the guide when position of the elongate member relative to the tether has been set. For example, the tether (52) may be in the form of a toothed belt (62).

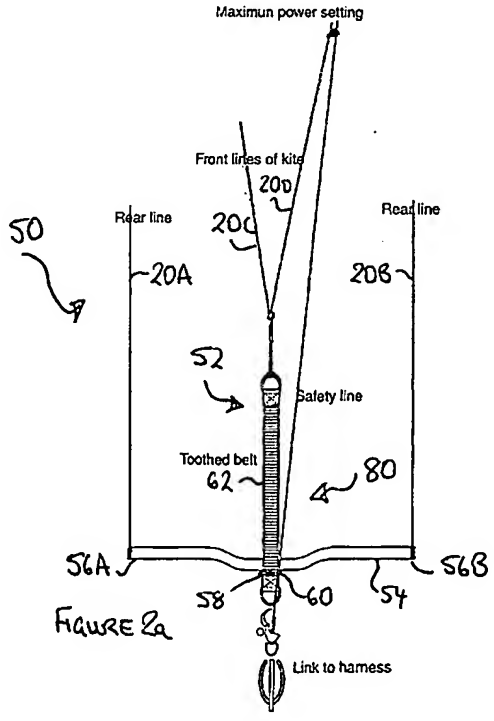

FIGURE 2a

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Description

[0001] The present invention relates to kites, particularly but not exclusively so-called power kites which are used to provide a means of propulsion.

[0002] Power kites are used to provide propulsion for kite-boarding and kite-karting. By the very nature of their use, there is a need for accurate and safe control of power kites. Figure 1 illustrates schematically the use of a power kite (10) in kite-boarding. An individual (12) standing on a board (14) floating on water (16) is controlling kite (10) through control bar (18). The kite (10) has four control lines (20A,B,C,D) extending from four corners (22A,B,C,D) of the kite. The two lines (20A,B) extending from the rear corners of the kite are attached to opposed ends (24) of the control bar (18), whilst the two lines (20C,D) extending from the front corners (22C, D) of the kite are joined at point 25 to a single tether (26) which is coupled to a harness worn by the individual (12). The control bar (18) is slidably mounted on the tether (26) such that the individual (12) can de-power or power the kite (10) by sliding the control bar (18) towards or away from point (25). Typically, the tether (26) passes through an aperture in a block strapped to one lateral side of the control bar (18).

[0003] There are occasions when the individual (12) might want or need to let go of the control bar (18). In such circumstances, it is desirable for the position of the control bar (18) relative to point (25) to remain unchanged so that there is no sudden change in power delivered by kite (10). An arrangement has been proposed for biasing the control bar (18) (with lines 20A,B), causing rotation to a position in use where the tether (26) is wrapped tight around part of the control bar (18) to provide significant frictional engagement. Such frictional engagement is intended to prevent undesirable movement of the control bar (18) relative to point (25) until such time as the individual counteracts the rotational bias, unwrapping the tether (26) from the control bar in order to adjust the position of the control bar (18).

[0004] The present applicant has found that considerable physical effort is required to counteract the known anti-slip mechanism provided on control bar/tether couplings, a factor which becomes particularly significant over prolonged periods of use. Furthermore, the applicant has found that the forces generated during flight place considerable stress on certain components, particularly those associated with where the rotational bias is induced and counteracted causing premature failure.

[0005] In an emergency, it may be necessary for an individual to free himself from the pull exerted by the power kite, or at least de-power the kite as rapidly as possible. In practice, this means not only releasing the control bar (18) but also decoupling the tether (26) from the harness worn by the individual. To avoid loss of the power kite, a safety line is sometimes used by an individual which allows the kite to de-power entirely whilst remaining anchored to the individual. One end of the safety line is coupled to the individual e.g. using a wrist strap, and the other is attached to one of the front lines. The length of the safety line is chosen so that, in use, one front line is longer than the other to enable the normally arcuate profile of the kite to flatten out completely. Once flat, substantially all power is lost from the kite.

[0006] The present applicant has recognised that there are problems associated with known safety lines, for example, it is common for safety lines to become entangled with the rear lines of the kite, particularly during complex manoeuvres.

[0007] In accordance with a first aspect of the present invention, there is provided a control assembly for a four-line power kite, comprising: a tether for tethering an individual to a pair of front lines of the power kite; an elongate member having a pair of opposed ends, each for attachment to one of a pair of rear lines of the power kite; and a guide member mounted on or in the elongate member between the opposed ends and defining an aperture for slidably receiving the tether when varying position of the elongate member along the tether, characterised in that the tether has a profile which provides a plurality of discrete positions for interengagement with a corresponding profile of the guide when position of the elongate member relative to the tether has been set.

[0008] The interengaging profiles provide an anti-slip mechanism which prevents unintentional movement of the elongate member along the tether. Thus, when the position of the elongate member has been set along the tether, the profiles are biased into interengagement. The bias may be provided by configuring the rear lines to provide a torque to the elongate member, urging the profiled surface of the tether against the corresponding profile of the guide. A resilient member might even be provided as an alternative source of bias. Thereafter, when the position of the elongate member relative to the tether is to be altered, the profiles are disengaged by counteracting the bias, enabling the guide to slide freely over the tether.

[0009] The tether may comprise a belt, and in one embodiment the tether is a toothed belt. The corresponding profile of the guide may be such that recesses between adjacent pairs of teeth on the toothed belt provide the plurality of discrete positions for interengagement. The corresponding profile of the guide may be defined, at least in part by a surface of the aperture.

[0010] The pair of opposed ends may define an axis therebetween, with the aperture in the guide being radially offset relative to the axis. The elongate member may have a central portion which is laterally offset relative to the opposed ends. The guide may be mounted on the central portion in such a way as to maximise spacing of the aperture from the axis.

[0011] Radially offsetting the guide paves the way for using torque applied to the elongate member to provide the requisite bias to bring the corresponding profiles into engagement. The radial offset is greatly enhanced by

laterally offsetting the central portion relative to the opposed ends. Furthermore, with a non-linear elongate member, it is mechanically easier to counteract the torque in order to disengage the profiles; simply pulling back on the opposed ends against the tension in the pair of rear lines causes pivotal movement of the elongate member about the point of engagement with the tether. The pivotal movement continues until the profiles disengage, with the elongate member being in the require orientation for movement along the tether.

[0012] In accordance with a second aspect of the present invention, there is provided a control assembly for a four-line power kite, comprising: a tether for tethering an individual to a pair of front lines of the power kite; an elongate member having a pair of opposed ends, each for attachment to one of a pair of rear lines of the power kite, the opposed ends defining an axis therebetween; and a guide member mounted on or in the elongate member between the opposed ends and defining an aperture for slidably receiving the tether when varying position of the elongate member along the tether, characterised in that the elongate member has a central portion which is laterally offset relative to the axis between the opposed ends.

[0013] The guide may be mounted on the central portion, perhaps with the aperture disposed as far as possible from the axis. The assembly may be used in combination with the first aspect of the invention, and thus the tether may comprise a toothed belt which interengages a corresponding profile associated with the guide.

[0014] In accordance with a third aspect of the present invention, there is provided safety apparatus for depowering a four-line power kite in an emergency, comprising:

> a tether for tethering an individual to a pair of front lines of the power kite; and
> a safety line, a first end of which is configured to be attached to one of the front lines and a second end of which is configured to be attached to the individual, characterised in that the tether is provided in two parts with a coupling therebetween configured to release one part from the other when decoupled, and in that the safety line is connected to one of the parts which, in use, remains with the individual when the coupling is decoupled.

[0015] The coupling may comprise a shackle, perhaps a snap shackle in which the loop of the shackle is held closed by a resiliently biased bolt. A pull cord or the like may be provided for decoupling the coupling, e.g. by urging the bolt against the bias in order to spring open the loop.

[0016] The part of the tether which in use remains with the individual when the coupling is decoupled may include a swivel connection. The swivel connection enables one end of the tether to rotate freely relative to the other end. The swivel connection may be disposed in use between the individual and the connection between the safety line and the associated part of the tether. In this way, the safety line will rotate with the power kite, preventing entanglement around the rear lines.

[0017] The other part of the tether (i.e. the part of the tether which remains attached to the pair of front lines of the power kite when the tether is decoupled) may have a non-circular cross-section. For example, the cross section may be square or may be substantially rectangular (e.g. a belt-like tether). A non-circular cross-section enables torque to be applied to the tether, for example as a result of engagement with an elongate member having a pair of opposed ends (e.g. for attachment to the rear lines of the power kite). Applying torque to the tether may be useful during complex manoeuvres. The non-circular section of the tether may even be provided by a toothed belt (as previously described) or any other suitable tether according to the first aspect of the present invention.

[0018] The safety line may comprise a resilient member (e.g. a bungee cord) configured to reduce slack. Since the length of the safety line is at least in part determined by the span of the kite, it is often necessary to have a safety line with a length in active use which exceeds the spacing between the individual and the point of attachment to the front line. Accordingly, to avoid undesirable slack, the safety line may be configured to be in tension when not deployed.

[0019] An embodiment of the invention will now be described by way of example, with reference to the accompanying drawings, in which:

> Figure 1 is a schematic illustration of a kite boarding arrangement;
> Figures 2a and 2b show schematically underside views (in two different positions) of a control assembly and safety apparatus embodying different aspects of the present invention;
> Figure 3 shows a perspective view of part of the control assembly of Figures 2a and 2b;
> Figure 4a and 4b show schematically the use of the control assembly of Figures 2a and 2b;
> Figure 5 is a perspective schematic view of the arrangement of Figure 4b; and
> Figures 6a and 6b show schematically detail of the safety apparatus of Figures 2a and 2b.

[0020] Figures 2a and 2b show schematically a control assembly (50) embodying the present invention, in maximum power and minimum power settings respectively. The assembly (50) comprises: a tether (52) for tethering an individual to a pair of front lines 20C,D of a power kite; an elongate member or control bar (54) having a pair of opposed ends (56A,B) each attached to one of a pair of rear lines (20A,B) of the power kite; and a guide (58) mounted on the elongate member (54) and defining an aperture (60) for slidably receiving the tether

(52) when varying the position of the elongate member (54) along the tether (52). The tether (52) comprises a toothed belt profile (62) which provides a plurality of discrete positions for interengagement with a corresponding profile of the guide (58) when the position of the elongate member (54) relative to the tether (52) has been set.

[0021] As is shown in Figure 3, elongate member (54) has a non-linear shape, with a central portion (70) which is laterally offset relative to axis AA which extends from one end (56A) to the other (56B). As is also shown in Figure 3, the guide (58) is formed by a "["-shaped bar (72) welded onto member (54), defining a slot shaped aperture (60). The aperture (60) is large enough for the toothed belt (62) to slide therethrough, with the bar (72) having a profile which fits in any one of the recesses between adjacent pairs of teeth on the belt (62).

[0022] Figure 4a shows schematically a side view of the toothed belt (52) engaged the elongate element (54) in such a way that the latter cannot slide along the former. In other words, bar (72) and a recess between a pair of teeth on the belt (62) are interengaged. In order to disengage the bar (72) from its recess in the belt (62), the ends (56A,B) are pulled towards the individual, causing the relative rotation of the member (54) to the position shown in Figure 4b. Rotation of the member (54) is achieved without twisting the bar with the wrists. Once the belt (62) is no longer urged against the bar (72), as shown in Figure 4b, the elongate member can be moved freely along the toothed belt as shown in Figure 5 to the desired position.

[0023] Figures 2a and 2b also show safety apparatus (80) comprising a safety line (82), one end (82A) of which is attached to one of the front lines (20D) and the other end (82B) of which is attached to the tether (52). In fact, tether (52) is formed in two parts, with an upper part (84) including the toothed belt (62) and with a lower part (86) including a harness linkage. The upper and lower parts (84,86) are releasably coupled by a snap shackle (88) which engages D ring (89).

[0024] Figures 6a and 6b show schematically the snap shackle (88) in closed and open configurations. In the closed configuration, pivotal gate (90) is held in place by a resiliently-biased bolt (91) which engages aperture (92). Thus the gate (90) retains the D ring (89) (not shown for clarity in Figure 6a). The body (94) of shackle (88) includes a closed loop (96) to which safety line (82) is attached.

[0025] When the safety apparatus (80) is to be activated, the individual simply pulls on release tag (98), withdrawing bolt (91) from aperture (92). Once freed, pivotal gate (90) opens, releasing D ring (89) and allowing the control assembly (50) to be pulled away from the individual. However, safety line (82) remains attached to body (94) of shackle (88), enabling the kite to de-power whilst remaining attached to the individual.

[0026] As shown in Figures 6a and 6b, the shackle (88) includes a swivel connection (100) at its base. The swivel connection enables the shackle (88) and safety line (82) to rotate with kite.

Claims

1. A control assembly (50) for a four-line power kite, comprising:

   a tether (52) for tethering an individual to a pair of front lines (20C,D) of the power kit;
   an elongate member (54) having a pair of opposed ends (56A,B), each for attachment to one of a pair of rear lines (20A,B) of the power kite; and
   a guide member (58) mounted on or in the elongate member between the opposed ends and defining an aperture (60) for slidably receiving the tether when varying position of the elongate member along the tether, **characterised in that** the tether has a profile which provides a plurality of discrete positions for interengagement with a corresponding profile of the guide when position of the elongate member relative to the tether has been set.

2. A control assembly (50) according to claim 1, in which the tether (52) comprises a belt.

3. A control assembly (50) according to claim 2, in which the tether (52) comprises a toothed belt (62).

4. A control assembly (50) according to claim 3, in which the corresponding profile of the guide member (58) is such that recesses between adjacent pairs of teeth on the toothed belt provide the plurality of discrete positions for interengagement.

5. A control assembly (50) according to claim 4, in which the corresponding profile of the guide is defined at least in part by a surface of the aperture (60).

6. A control assembly (50) according to any one of the preceding claims, in which the pair of opposed ends (56A,B) of the elongate member (54) define an axis therebetween, with the aperture (60) in the guide member (58) being radially offset relative to the axis.

7. A control assembly (50) according to claim 6, in which the elongate member (54) has a central portion (70) which is laterally offset relative to the opposed ends (56A,B).

8. A control assembly (50) according to claim 7, in which the guide member (58) is mounted on the central portion (70), with the aperture (60) disposed

to maximise spacing from the axis.

9. Safety apparatus (80) for de-powering a four-line power kite in an emergency, comprising:

a tether (52) for tethering an individual to a pair of front lines (20C,D) of the power kite; and
a safety line (82), a first end (82A) of which is configured to be attached to one of the front lines and a second end (82B) of which is configured to be attached to the individual, **characterised in that** the tether is provided in two parts (84,86) with a coupling (88,89) therebetween configured to release one part from the other when decoupled, and **in that** the safety line is connected to one of the parts (86) which, in use, remains with the individual when the coupling is decoupled.

10. Safety apparatus (80) according to claim 9, in which the coupling comprises a shackle.

11. Safety apparatus (80) according to claim 10, in which the coupling is a snap shackle (88).

12. Safety apparatus (80) according to any one of claims 9 to 11, in which the coupling comprises a pull cord (98) for decoupling the coupling (88,89).

13. Safety apparatus (80) according to any one of the preceding claims, in which the part of the tether (86) which remains with the individual when the coupling is decoupled comprises a swivel connection (100).

14. Safety apparatus (80) according to claim 13, in which the swivel connection (100) is disposed in use between the individual and the connection between the safety line (82) and the respective part of the tether.

15. Safety apparatus according to any one of claims 9 to 14, in which the safety line (82) comprises a resilient member configured to take up slack in the safety line.

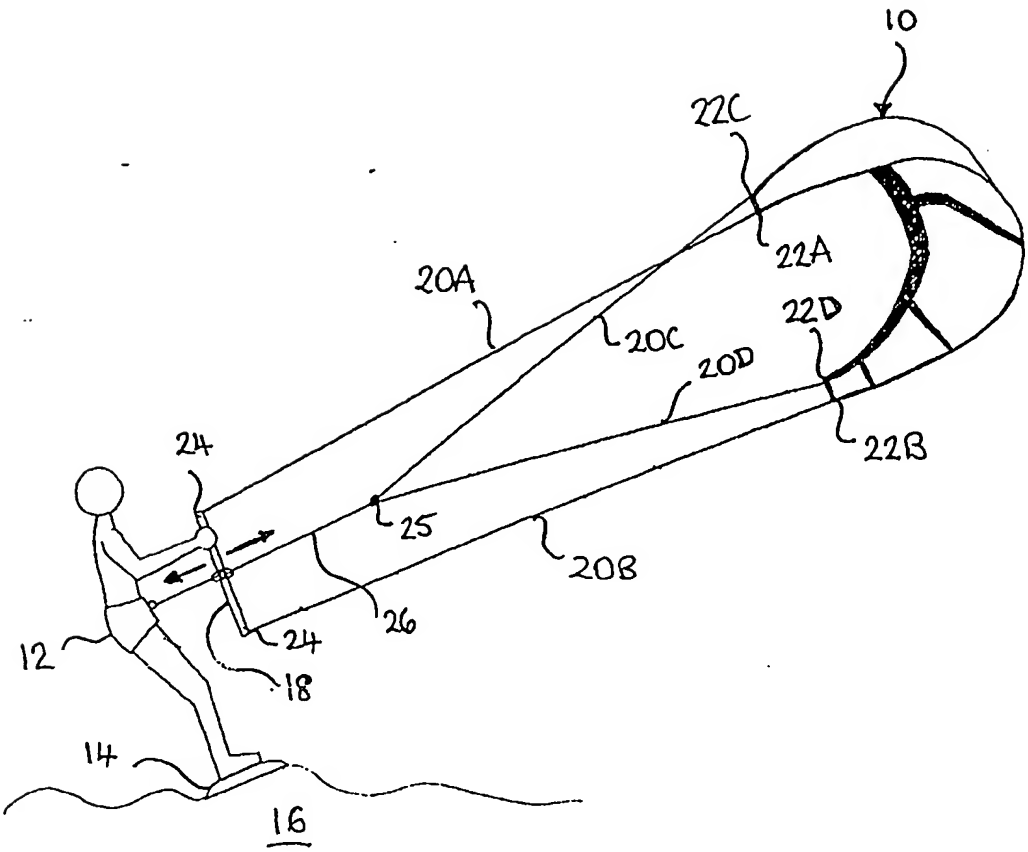


FIGURE 1.

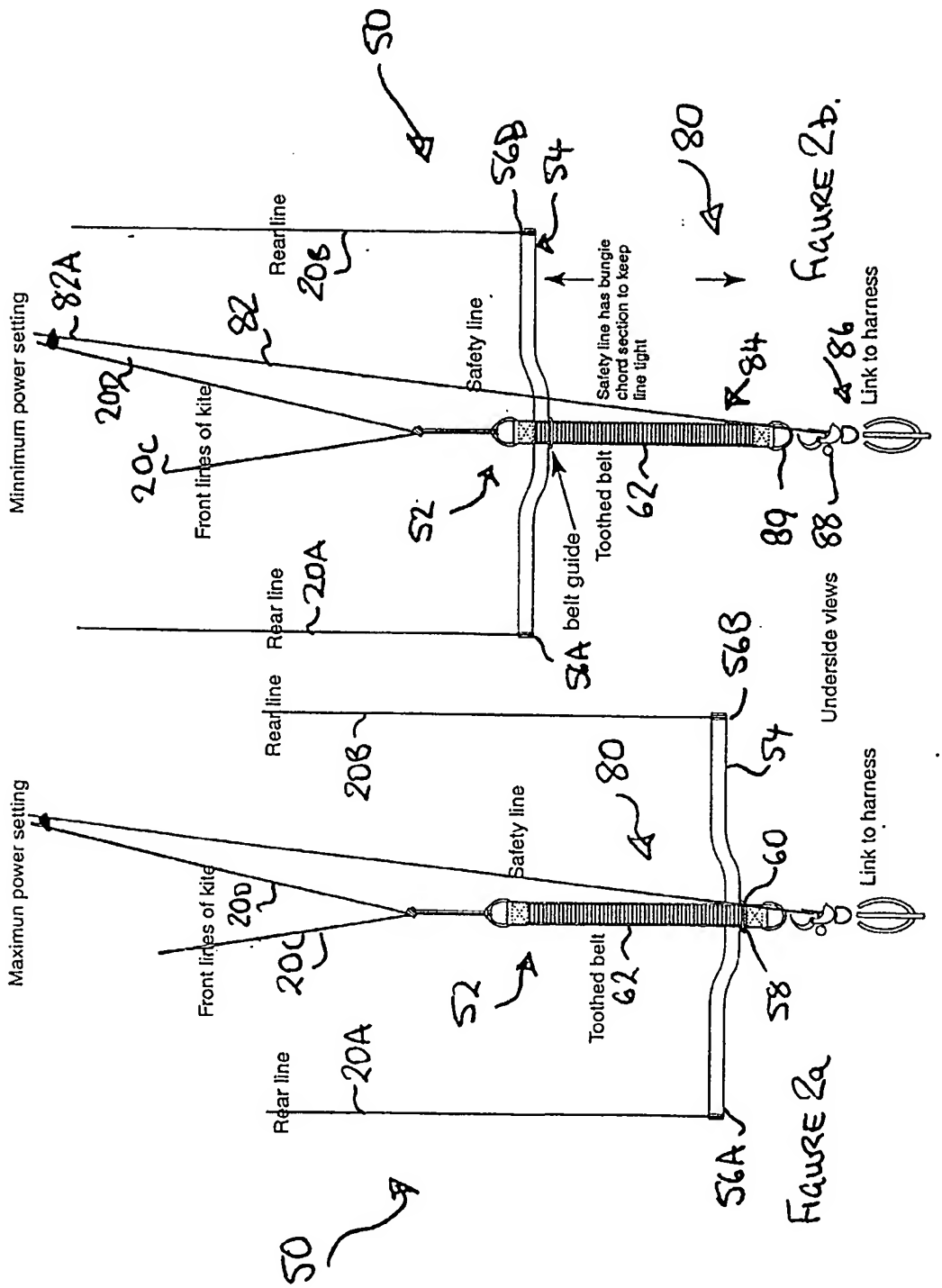


Figure 2a

Figure 2b.

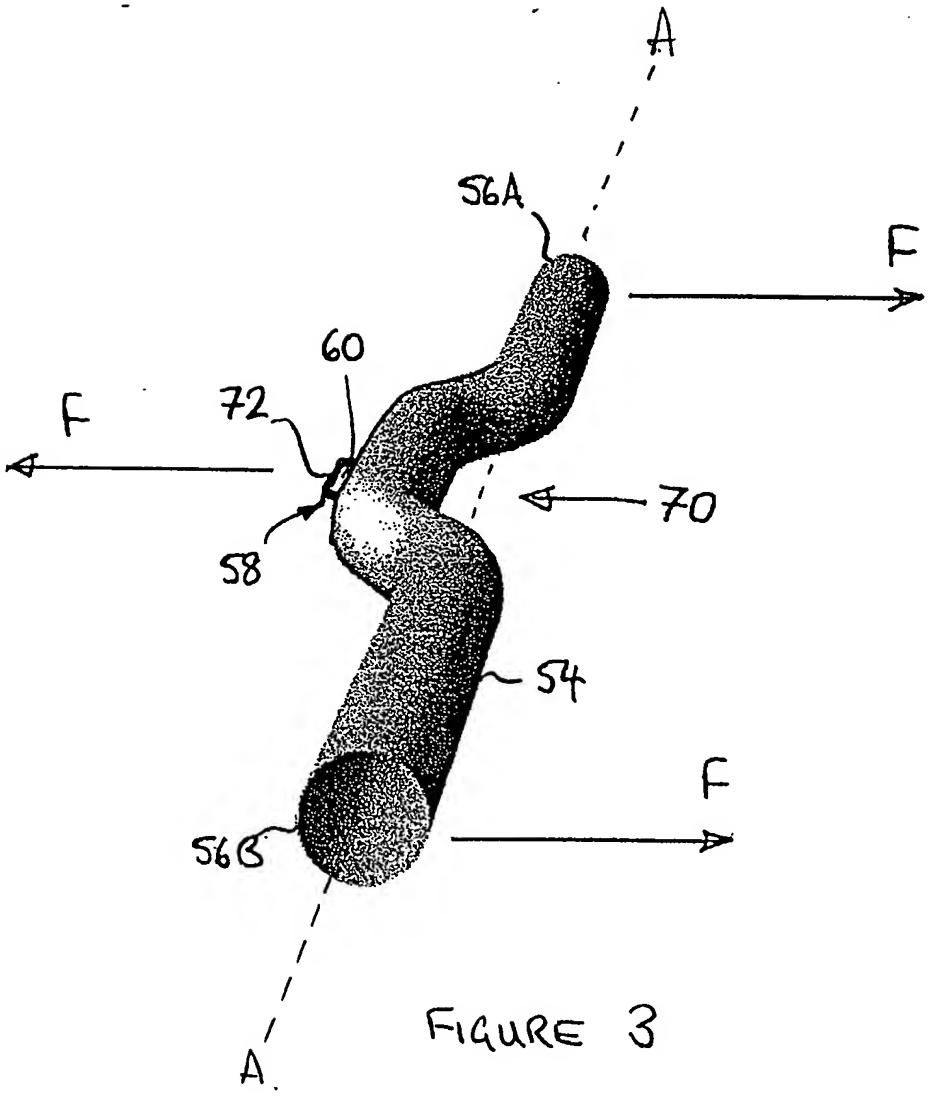
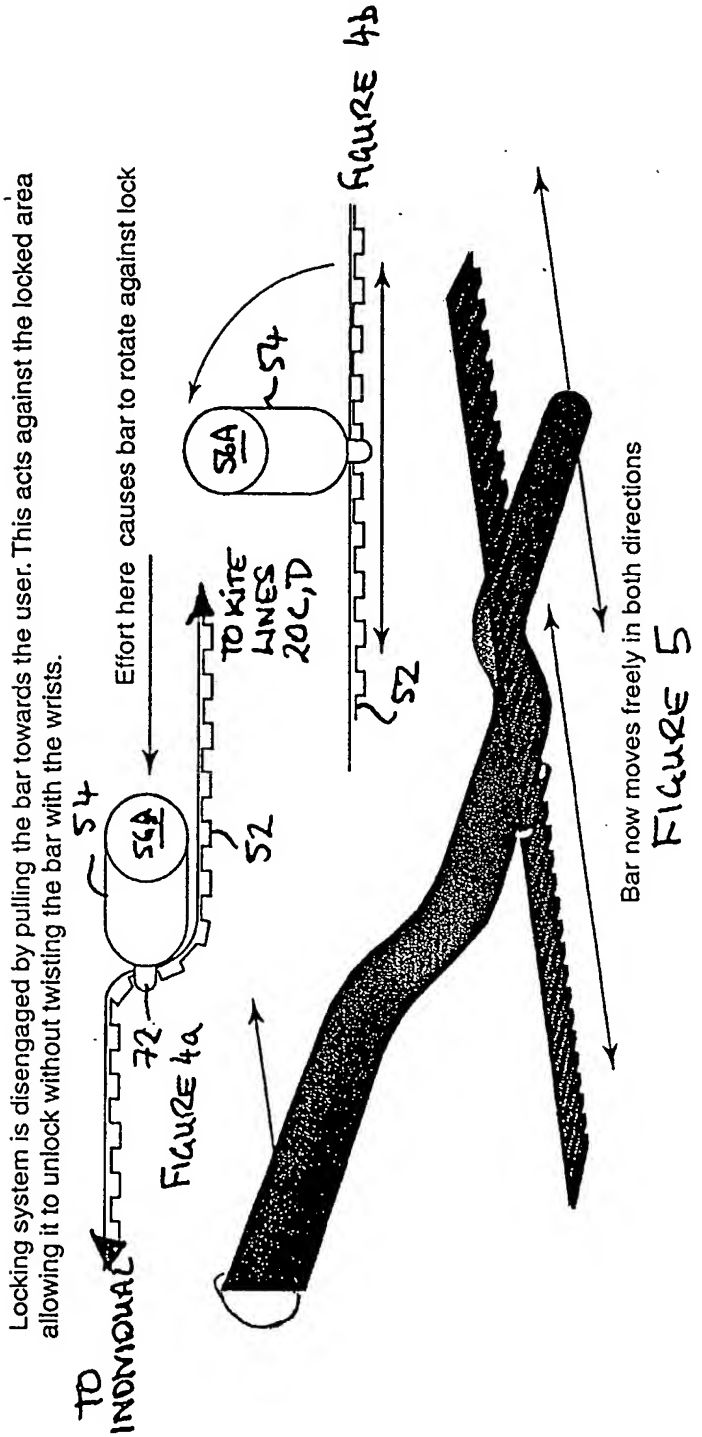


FIGURE 3


Locking system is disengaged by pulling the bar towards the user. This acts against the locked area allowing it to unlock without twisting the bar with the wrists.
TO INDIVIDUAL
54
54A
72
FIGURE 4a
Effort here causes bar to rotate against lock
TO KITE LINES 20C,D
52
54A
54
52
FIGURE 4b
Bar now moves freely in both directions
FIGURE 5

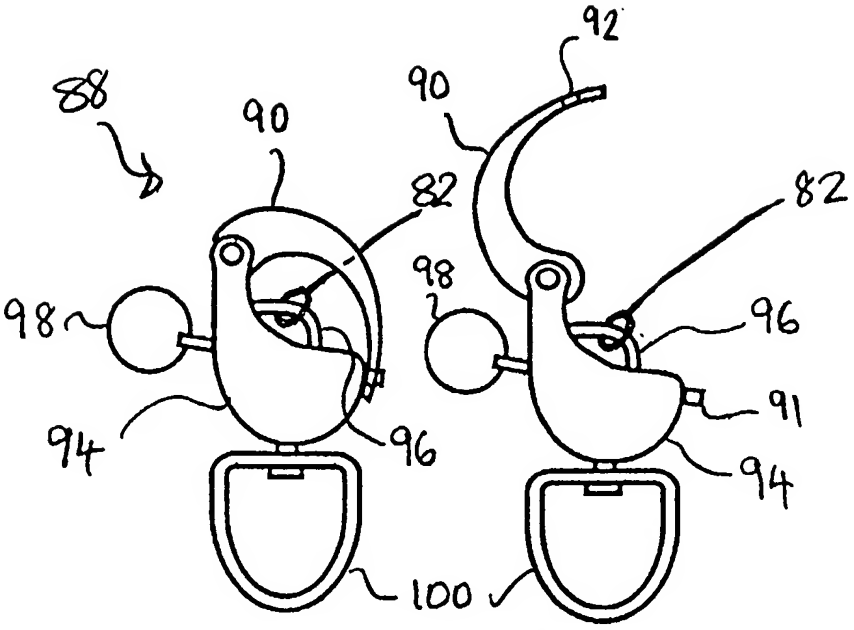


FIGURE 6a FIGURE 6b